CLAIMS

1. A Brayton cycle apparatus, being characterized by:

a scroll compressor for compressing a working fluid;

a scroll expander for operating in cooperation with an orbiting action of the scroll compressor, wherein the working fluid compressed by the scroll compressor is fed to the scroll expander; and

a heating device for heating the compressed working fluid fed from the scroll compressor to the scroll expander.

2. The Brayton cycle apparatus according to claim 1, characterized in that:

the scroll compressor includes a compressor case, a fixed compression scroll formed in the compressor case, and an orbital compression scroll combined with the fixed compression scroll to come in contact with the compressor case in a slidable manner or to face the compressor case with a narrow gap therebetween; and

the scroll expander includes an expander case, a fixed expansion scroll formed in the expander case, and an orbital expansion scroll combined with the fixed expansion scroll to come in contact with the expander case in a slidable manner or to face the expander case with a narrow gap therebetween, the Brayton cycle apparatus further being characterized by:

an orbital partitioning wall for generating an orbiting action, wherein the orbital compression scroll and the orbital expansion scroll are arranged on the orbital partitioning wall in a manner that the orbital compression scroll and the orbital expansion scroll are located at opposite sides of the orbital partition.

3. The Brayton cycle apparatus according to claim 2, characterized in that the scroll compressor releases heat

transferred from the scroll expander to the orbital partitioning wall in the atmosphere through the compressor case.

4. The Brayton cycle apparatus according to claim 2 or 3, characterized in that the expander case includes a heat absorption chamber into which the working liquid introduced into the scroll expander prior to expansion is introduced, the heat absorption chamber being partitioned by a wall for heating the working liquid when the working liquid is expanding.

5. The Brayton cycle apparatus according to any one of claims 1 to 4, characterized in that the scroll compressor uses atmospheric gas as the working fluid, compresses the atmospheric gas, and releases the expanded working fluid into the atmosphere.

6. The Brayton cycle apparatus according to any one of claims 1 to 5, characterized in that the heating device is a heat exchanger for transferring external heat to the working fluid through heat exchange.

7. The Brayton cycle apparatus according to any one of claims 1 to 6, characterized in that a wall surface of the expander is kept warm.

8. A Brayton cycle apparatus being characterized by:

a positive-displacement compressor for compressing a working fluid;

a scroll expander for generating an orbiting action in cooperation with a compression action of the positive-displacement compressor, wherein the working fluid compressed by the positive-displacement compressor is fed to

the scroll expander; and

a heating device for heating the compressed working fluid fed from the positive-displacement compressor to the scroll expander.

9. The Brayton cycle apparatus according to claim 8, characterized in that a wall surface of the expander is kept warm.

10. An exhaust heat energy recovery apparatus for an internal combustion engine for recovering exhaust heat energy of the internal combustion engine as kinetic energy, wherein the exhaust heat energy recovery apparatus incorporates a Brayton cycle apparatus, the exhaust heat energy recovery apparatus being characterized in that the Brayton cycle apparatus includes:

a compressor for compressing a working fluid; and

an expander to which the working fluid compressed by the compressor is fed, wherein the compressed working fluid fed from the compressor to the expander is heated by heat transferred from a flow passage wall of an exhaust flow passage of the internal combustion engine.

11. The exhaust heat energy recovery apparatus according to claim 10, characterized in that:

the compressor is a scroll compressor and the expander is a scroll expander; and

the Brayton cycle apparatus includes a heating device for heating the compressed working fluid that is fed from the scroll compressor to the scroll expander, and the heating device is a heat exchanger that is arranged to contact exhaust of the internal combustion engine to transfer heat from the flow passage wall to the working fluid.

12. The exhaust heat energy recovery apparatus according to claim 10 or 11, wherein the exhaust flow passage is formed as a double pipe having an inner passage and an outer passage, and exhaust flowing through one of the inner passage and the outer passage exchanges heat with the working fluid flowing through the other one of the inner passage and the outer passage.

13. The exhaust heat energy recovery apparatus according to claim 10, characterized in that:

the compressor is a scroll compressor including a compressor case, a fixed compression scroll formed in the compressor case, and an orbital compression scroll combined with the fixed compression scroll to come in contact with the compressor case in a slidable manner or to face the compressor case with a narrow gap therebetween;

the expander is a scroll expander including an expander case, a fixed expansion scroll formed in the expander case, and an orbital expansion scroll combined with the fixed expansion scroll to come in contact with the expander case in a slidable manner or to face the expander case with a narrow space therebetween, the Brayton cycle apparatus further being characterized by:

a heating device, for heating the compressed working fluid fed from the scroll compressor to the scroll expander with heat from the flow passage wall, and an orbital partitioning wall for generating an orbiting action, wherein the orbital compression scroll and the orbital expansion scroll are arranged on the orbital partitioning wall in a manner that the orbital compression scroll and the orbital expansion scroll are located at opposite sides of the orbital partition; and

wherein the orbital partitioning wall and the compressor case are made of a high heat-conductive material, and the expander case is made of a heat-resistant material.

14. The exhaust heat energy recovery apparatus according to claim 13, characterized in that an aluminum alloy is used as the high heat-conductive material, and an iron alloy is used as the heat-resistant material.

15. The exhaust heat energy recovery apparatus according to any one of claims 10 to 14, characterized in that a wall surface of the expander is kept warm.

16. A Brayton cycle apparatus being characterized by:

a scroll expander including an orbital expansion scroll and a fixed expansion scroll combined with the orbital expansion scroll;

a compressor for compressing a working fluid in cooperation with an orbiting action of the orbital expansion scroll;

a compressed working fluid flow passage for supplying the compressed working fluid from the compressor to the scroll expander; and

a heat source for heating the working fluid in the scroll expander through heat transfer.

17. The Brayton cycle apparatus according to claim 16, characterized in that the compressor is a positive-displacement compressor.

18. The Brayton cycle apparatus according to claim 16 or 17, characterized in that:

the scroll expander has a case fixed to the fixed expansion scroll; and

the heat source comes in contact with the case and thereby heating the working fluid in the scroll expander through the case or the fixed expansion scroll.

19. A Brayton cycle apparatus being characterized by:

an orbital partitioning wall having a first surface on which an orbital compression scroll is formed and a second surface on which an orbital expansion scroll is formed;

a scroll compressor including the orbital compression scroll and a fixed compression scroll combined with the orbital compression scroll;

a scroll expander including the orbital expansion scroll and a fixed expansion scroll combined with the fixed expansion scroll;

a compressed working fluid passage for supplying a compressed working fluid from the scroll compressor to the scroll expander; and

a heat source for heating the working fluid in the scroll expander through heat transfer.

20. The Brayton cycle apparatus according to claim 19, characterized in that the scroll compressor has a compressor case arranged on the first surface, the scroll expander has an expander case arranged on the second surface, the compressed working fluid passage has a through-hole formed in the orbital partition, and the through-hole communicates the interior of the compressor case with the interior of the expander case.

21. The Brayton cycle apparatus according to claim 19, characterized in that:

the scroll expander has a case fixed to the fixed expansion scroll; and

the heat source comes in contact with the case thereby heating the working fluid in the scroll expander through the case or the fixed expansion scroll.

22. An exhaust heat energy recovery apparatus for recovering exhaust heat energy discharged from an internal combustion engine through an exhaust flow passage as kinetic energy, the exhaust heat energy recovery apparatus being characterized by:

a Brayton cycle apparatus including an expander to which a working fluid is fed, wherein the working fluid fed to the expander is heated by heat transferred from a flow passage wall of the exhaust flow passage.

23. The exhaust heat energy recovery apparatus according to claim 22, characterized in that:

the expander is a scroll expander including an orbital expansion scroll and a fixed expansion scroll combined with the orbital expansion scroll, the Brayton cycle apparatus further including:

a compressor operated in cooperation with an orbiting action of the orbital expansion scroll to compress the working fluid;

a compressed working fluid passage for supplying the working fluid from the compressor to the scroll expander; and

a heat source for heating the working fluid in the scroll expander through heat transfer, wherein an exhaust of the internal combustion engine is used as the heat source.